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[illegible], TO [illegible],
ILLINOIS, AND NEW YORK CITY - JUNE, 1949.

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Transportation Test with Early White Rose Potatoes
from Kern County, California, To Chicago,
Illinois, and New York City - June, 1949.

This was the third transportation test made with early potatoes from Kern County, California, to determine the relative effectiveness of standard refrigeration and various modified services using less ice. Eliminating the wasteful use of ice without damaging the commodity would benefit shippers and carriers alike. In the first two tests made in May and June, 1948, reported in H. T. & S. Office Reports 139 and 191, initial icing at Bakersfield, California, plus one re-icing in transit (Rule 247a) gave adequate refrigeration to eastern markets during the moderate weather encountered at the time the tests were made. Shipping tests made in early July indicated the possible need of two or more re-icings during hotter weather.

In the current test initial icing at Bakersfield plus two re-icings in transit (Rule 247b) was compared with standard refrigeration (Rule 200). Other cars in the test included one car with "fans on" iced according to Rule 247b, two stage iced cars, fans off, and one car destined for potato chip manufacture, shipped under standard ventilation (without ice). The stage iced cars were under special icing instructions for this test. They were given only two re-icings west of Chicago in an attempt to moderate the temperature in the bottom layers of the load which may be lower than desirable for potatoes when the conventional icing schedule is used.

Table 1 presents a list of the test cars, protective service used, the stations where ice was supplied, destination of cars, and the cost of refrigeration for each.

Test Cars

The test cars were similar in age and were of average condition. They were 40' end bunker cars with convertible ice bunkers, steel sheathed, and with 3" insulation in walls and ends, and 3 1/2" in floor and roof. All were equipped with air circulating fans (Preco), and had 7 1/2" floor racks. Ice capacity was 11,300 lbs. for full bunkers and 5,600 lbs. when ice grates were raised for stage ice service. With standard ventilation the air movement was indirect (inlet at the rear end of car).

Temperature and Icing Records

Potato and air temperatures were taken en route with electric resistance thermometers that could be read from the roof of the car without opening the doors. The thermometers were inserted into potatoes in top, middle, and bottom layer bags in the middle row of the first (bunker), sixth (quarterlength), and eleventh (doorway) stacks, using the forward end of the car. Temperature of the air inside the car was taken under the floor rack near the front bunker (B.B.Air), near the top bulkhead opening (T.B.Air), and near the ceiling at the doorway (T.D.Air). A recording thermometer was attached underneath one of the cars to obtain the outside temperature. In the car shipped under standard ventilation (Car 7), the temperature of potatoes in the middle layer of the rear quarterlength of the car was taken instead of top doorway air temperature.

The amount of ice supplied the cars was determined by block count; fresh ice of known average weight per block being used at all stations. The amount of ice remaining in the bunkers at destination was estimated in units of 1/8's of full capacity.

Loading

Loading and shipping data appear in Table 2. The potatoes were shipped in 100-lb. burlap bags. Cars 1, 2, 3, and 7 contained 360 bags loaded on their sides 3 rows crosswise of the car, 5 layers high, for 11 stacks in each end of the car. A wedge of 30 bags was placed in the doorway to make a continuous (through) load. Cars 4, 5, and 6 contained 400 bags loaded the same as above but with an additional layer of 2 rows of 10 bags in each end of the car making a "deck" layer of 40 bags. Railroad billing weights were 36,360 lbs. for 360-bag loads and 40,400 lbs. for 400-bag loads.

All cars were loaded dry (without ice) and forwarded to Bakersfield with all ventilators open (stand. vent.) where the "icers" were initially iced to capacity the day after loading. All ventilators were closed after initial icing. Car 7 for potato chips did not receive any ice and all ventilators were kept open to destination.

Commodity

The potatoes were mature U. S. No. 1 washed White Rose in cars 1 to 6, inclusive. Those in cars 1, 2, and 3 were from a single field near Cawelo and had a slight amount of scab, heat injury, and browning. There was less than 1% soft rot (Table 2). Potatoes in cars 4 to 6, inclusive, were from a single field near Wheeler Ridge. They had some insect and growth crack injury and slight heat injury and browning. There was practically no soft rot. Most of the tubers from both fields were skinned at the bud end to the extent of 5 to 10 percent of the entire surface of the tuber. The potatoes for potato chips in Car 7 were U. S. No. 2 grade grown near Arvin. They were mature (no skinning) but had slight heat injury. There was no browning or soft rot.

In cars 1 to 6 inclusive, three weighed bags (50-lb. size) were placed in the top doorway position of each load. The potatoes were from the same field used for the commercial loads in these cars. No "test" bags were placed in Car 7 because its final destination was uncertain at time of loading.

Weather and Route

Loading day was warm and near normal for the season with a morning temperature of 77°F. and 98° after noon. The temperature of the potatoes was 73° to 74° in the three cars loaded during the morning and 77° to 82° in the other four cars loaded during the afternoon.

Hot days and warm nights were encountered en route. The mean maximum temperature for the trip was about 97° and the mean minimum at night was 68°. Both were more than 10 degrees higher than those of the June test last year.

The cars were on the same train to Argentine near Kansas City, Mo., where Car 7 was diverted to Decatur, Illinois. The remaining cars were accompanied to Corwith, near Chicago, Illinois, and Jersey City. Cars 1 to 3, inclusive, were unloaded at the team track terminal in Chicago. Cars 4 to 6, inclusive, which were accompanied to the Jersey City terminal, were finally diverted to Brooklyn, N. Y., for unloading.

The routing was Santa Fe to Chicago, Belt Railroad Company of Chicago and Erie Railroad from Chicago to Jersey City. The test cars were assembled at Bakersfield, California, and departed 6 p.m., P.S.T. June 22. The trip log is given in Table 3.

RESULTS

Transit Temperatures

The temperatures obtained in transit for each car are shown separately in figures 1 to 7. Each figure shows (1) the temperature of the potatoes in the warmest and coldest positions in the load (maximum at top doorway or top quarterlength; minimum at bottom bunker), (2) the average temperature of the top, middle, and bottom layers of the load, and (3) the air temperature inside the car; at two points above the load--(a) near the top bulkhead opening and (b) near the doorway, and at one point under the floor rack, near the bunker.

Rule 200 vs. Rule 247b

Figures 4 and 5 can be used to compare the effectiveness of modified icing. Rule 247b (Car 5) and standard refrigeration, Rule 200 (Car 4). Both loads were comparable in weight (40,400 lbs.) and in initial temperature (about 30°F.). There was little difference between these cars in the rate of cooling of the potatoes in the warmest positions - top quarterlength of Car 4 and top doorway of Car 5. With both cars it took about 4 days after initial icing for potatoes at these positions to cool to 50°. Potatoes in the coldest position (bottom bunker) cooled to a lower temperature with standard refrigeration (Car 4) than with modified icing (Car 5) reaching 34° and 39°, respectively. Other studies have shown that temperature below 45° are not necessary for potatoes and may even be harmful by preventing the suberization of cuts and skinned areas. The effect of chilling temperatures will be discussed later. The average temperature of the top, middle, and bottom layers of the loads and the air temperature in the car all indicate that initial icing at Bakersfield plus re-icing at Belen and Corwith was as effective as standard refrigeration for shipments to New York City.

Fans on vs. Fans Off

Figures 1 and 2 can be used to compare transit temperatures obtainable with "fans on" and "fans off." Car 1(fans off) and Car 2 (fans on) were comparable in weight of load (36,360 lbs.) and in icing instructions. The loading temperature of Car 1(fans off) was 10 degrees colder than Car 2 (fans on) placing the greatest heat load on the car with fans on. The potatoes in the top doorway bags cooled much faster with fans on and reached 50° about 24 hours after initial icing compared with the nearly 5 days required with fans off.

Bottom bunker bags cooled rapidly in both cars, leveling off at about 40° with fans on and at about 35° with fans off. As with Cars 4 and 5 discussed above, the bottom layers were colder than necessary in both instances. There was a striking difference in the temperature spread between the coldest and warmest positions within each car. Usually this spread was less than 5 degrees with fans on and more than 15 degrees with fans off, and an even greater spread with fans off during the initial cooling period. With a minimum spread in temperature it is easier to obtain the optimum temperature for the entire load. The commodity and air temperature records obtained all show that the temperatures in the car with "fans on" were preferable to those in the car "fans off". The transit temperature indicates that one re-icing in transit, at about Belen or Waynoka, would have been sufficient for shipments as far as Chicago, especially with fans on to cool the top layer. Similar results were obtained last year.

Stage Icing

The test with stage icing was made to see if reducing the amount of ice in the bunkers would raise the transit temperature in the bottom layers of the load to the 45° or 50° level. Holding tests have shown that unsuberized early White Rose potatoes become more shrunken and browned at the skinned bud end after storage at temperatures below 50° than at higher temperatures.

By comparing figure 6 (stage icing to New York City) with figure 5 (full bunker icing), it is evident that stage icing (5,600 lb. capacity) with three re-icings in transit resulted in nearly the same transit temperatures as full bunker icing (11,300 lbs. capacity) with two re-icings en route. With stage icing there was a rise in temperature of the load for a short time between Belen and Waynoka when the ice supply was nearly gone prior to the second re-icing. This temporary setback in cooling extended the time the top layer was above 50° to 5 1/2 days but had little effect on the bottom layer bags since they remained below 50° despite the temporary depletion of the ice. If the fans had been operated in the stage iced car the top layer would have cooled faster. Transit temperatures in stage ice Car 3 to Chicago were similar to those in duplicate Car 6.

Stage icing with fans off did not moderate the temperature in the bottom layers of the load as was expected. Apparently stage iced cars must be forwarded with fans on if bottom layer temperatures of about 45° are desired. Initial icing plus 2 re-icings in transit were sufficient in the stage ice cars to carry the loads to Chicago and a third re-icing was enough for destinations as far east as New York City. However, with the above modified icing schedule the ice in the bunkers may be entirely used up upon arrival at the market and re-icing at destination might become necessary if the cars are not unloaded promptly.

Standard Ventilation

In Car 7 (Fig. 7) sold for potato chip manufacture and shipped without ice and with all ventilators open, there was no cooling en route except for about 48 hours starting a little west of Winslow, Arizona, when nights were cool and afternoon temperatures were moderate. The initial temperature of the potatoes was 74° F. and during the early part of the trip the temperature in the top layer of the load rose 6 degrees owing to the high outside temperature. Later this layer cooled 13 degrees during cooler weather and then warmed

up again to about 80° when warm weather was again encountered. The middle and bottom layers were affected less than the top layer by the outside temperatures because they were less exposed to the incoming air. Temperatures obtained in the middle layer lengthwise of the car indicated that in this car with indirect ventilation (air intake at rear end) the rear quarterlength and doorway positions were affected more by changes in the outside temperature than the forward quarter-length and forward bunker positions.

Ice Meltage

Ice meltage in transit with 36,360-lb. loads to Chicago was 14,700 lbs. in Car 1 which was relatively cool (74°) when loaded, shipped Rule 247b, fans off. In Car 2 which was warmer (82°) when loaded and was similarly iced, but shipped with fans on, meltage was 2,200 lbs. more (table 4). The higher initial temperature of the load in Car 2 probably accounts for most of this additional meltage. Meltage in "cool" stage ice Car 3 (73° when loaded) totaled 12,500 lbs. to Chicago. Undoubtedly this car would have used more ice if it had been re-iced at every regular icing station, as provided in the tariff.

With the 40,400-lb. loads sent to New York City, Car 4 with standard re-frigeration melted 21,725 lbs. of ice in transit; Car 5 with modified refrigeration (Rule 247b) used 20,725 lbs.; stage ice Car 6 melted a total of 13,000 lbs. The initial temperature of these cars was nearly the same ranging from 77° to 82°, but Cars 5 and 6 did not cool as much as Car 4 which accounts for less meltage in these cars.

Weight Loss

The loss in weight in transit of potatoes in 50-lb. bags from the top doorway position of the load ranged from 1.8 to 8.6 percent. This wide range was probably due to differences in the amount of skinning of the tubers. Most bags lost between 2 and 3 percent, table 5. During 3 days holding for observation at store temperature (Chicago) 5 out of 9 bags lost between 1.4 and 3.2 percent. Weight loss above and below these amounts occurred in other bags. During 2 days holding at New York, comparable lots of potatoes selected for similarity of skinned areas showed less variation in weight loss between lots, averaging 2.5 percent.

The different icing methods used in this test had little effect on the weight loss of potatoes in the top doorway position of the load, probably because the transit temperature was nearly the same in all instances. The effect of different transit temperatures on weight loss of skinned potatoes as obtained by holding samples taken from bottom bunker and top doorway bags will be discussed later.

There were noweighed bags in Car 7.

Decay in Transit (Iced Cars)

At time of loading, the potatoes in Cars 1, 2, and 3 had a little more soft rot and heat injury than those in Cars 4, 5, and 6 (Table 2). Upon arrival at Chicago the three 50-lb. test bags in each of Cars 1, 2, and 3 were removed and held at room temperature (80°F.) for observation. Decay was observed as follows:

Car	Refrigeration	Percent Decay in 3 top Doorway Test Bags			
		Arrival		After 3 days	
		Range	Mean	Range	Mean
1	R. 247b. Fans off.	0 - 2.9	1.3	0 - 4.0	2.2
2	R. 247b. Fans on.	.9 - 2.0	1.6	.9 - 6.0	2.9
3	Stage ice. Fans off.	0 - 4.5	2.0	0 - 4.5	2.0

There was no significant difference in amount of decay in these bags due to the different methods of refrigeration. Decay in the commercial load (average of 2 top doorway bags and 2 bottom bunker bags) at time of unloading was:

Car	Refrigeration	Date	Decay (%)	
			Top Doorway	Bottom Bunker
1	R. 247b. Fans off.	6/28	3.0	.6
2	R. 247b. Fans on.	6/30	1.6	5.6
3	Stage ice. Fans off.	7/1	4.4	3.2

Most of the trouble was soft rot following heat injury in the field or following transit bruising which was most noticeable in the bottom layer bags and not due to high temperature in transit.

Cars 4, 5, and 6 showed no decay in the test bags upon arrival in New York City after holding for further observation. In the commercial load, an occasional potato was found with soft rot in the bottom layer bags, probably due to transit bruising. There was no difference in decay due to the refrigeration used.

Browning of Skinned Potatoes (Iced Cars)

The test bags of potatoes and others from the commercial load were inspected for surface browning of the skinned areas. Severe browning noted upon arrival at Chicago and after holding 3 days was as follows:

Car	Refrigeration	Percent Severe Browning in 3 Top Doorway Test Bags			
		Arrival		After 3 days	
		Range	Mean	Range	Mean
1	R. 247b. Fans off.	0 - 8.5	4.7	4.5 - 19.1	12.2
2	R. 247b. Fans on.	0 - 8.7	4.6	4.4 - 18.2	11.5
3	Stage ice. Fans off.	0 - .7	.2	1.8 - 2.2	2.0

Apparently the high transit temperature in Car 3 (stage iced) T. D. Min. 54° resulted in less browning than where the 50° and 40° levels were reached in the top doorway bags of full bunker Cars 1 and 2. Similar results appeared in the commercial load where severe browning (average of 2 top doorway bags and 2 bottom bunker bags) at time of unloading was:

Car	Refrigeration	Date	Severe Browning (%)	
			Top Doorway	Bottom Bunker
1	R. 247b. Fans off.	6/28	2.2	7.3
2	R. 247b. Fans on.	6/30	2.5	1.6
3	Stage ice. Fans off.	7/1	0	0

In Cars 4 and 6, 50-lb. samples of potatoes were taken from the top doorway and bottom bunker positions upon arrival in New York City and held 2 days at 85° to 90° (the prevailing weather) for observation. Samples from Car 5 unloaded later were not held for observation after unloading.

The amount of severe browning was:

Car	Refrigeration	Date	Severe Browning (%) 1st Inspection		After 2 days	
			TD	BB	TD	BB
4	R. 200. Fans off.	7/5	2.0	0	8.0	10.0
5	R. 247b. Fans off.	7/7	9.0			
6	Stage ice. Fans off.	7/5	0	3.0	8.0	8.0

In this group of cars there was no consistent difference in browning due to the icing methods used or to the location of the potatoes in the cars probably because the temperature dropped below the 50° level in all of them.

Effect of Transit Temperature on Skinned Potatoes

As mentioned before, it is known that potatoes wounded by skinning will heal or "suberize" without browning if held in a warm, moist atmosphere. Healing is retarded or prevented altogether by low temperature. With normal healing (healing without browning) a corky layer lining is produced by the cells lying near the surface of the potato which prevents infection by bacterial soft rot and excessive evaporation of moisture from the skinned area. Thus, skinned potatoes held under favorable conditions for normal healing in transit should lose weight slower than those held under unfavorable conditions.

To observe the effect of transit temperature on the healing of skinned potatoes samples of 10 potatoes each were taken from top doorway and bottom bunker bags of Cars 4 and 6 after they had arrived at New York City. The potatoes were selected to make the samples comparable regarding size of potato and amount of surface area skinned. A supplemental sample was taken from the top quarterlength position of Car 6.

A comparison of weight loss of potatoes during holding for 2 days after removal from the car(Table 6) with the average and minimum transit temperature of the potatoes is as follows:

Car	Position	Transit Temperature (°F.) Ave	Min	Ave. loss Wt. (%) in 2 days
6	Top Quarter	59.1	48.0	1.8
6	Top Door	56.3	46.0	2.5
4	Top Door	54.0	44.0	2.2
6	Bottom Bunker	45.7	38.[illegible]	2.9
4	Bottom Bunker	40.5	34.0	3.0

This indicates a trend toward greater moisture loss from skinned potatoes with lower transit temperatures. It was also observed that there was more "severe" and "very severe" browning and shrivel of the skinned bud ends in the samples from the cold part of the load than in the warmer samples (Table 6).

Condition of Potato Chip Stock Shipped Under Standard Ventilation

Car 7 - Standard Ventilation for potato chip manufacture - was unloaded June 28 at Decatur, Illinois. The fans had been turned on after the car left the test train at Kansas City (Argentine) June 26. Upon arrival at Decatur the outside temperature was 90°. Potato temperature in the car was 80° in top layer bags at both A and B ends of the car, 80° in top doorway and bottom doorway bags, and 79° in the middle layer at the quarter length position. The load of these mature, sound U.S. #2 potatoes had less than 1 percent decay at destination. Some tubers in the top layer of the load were slightly withered, but this was not objectionable in stock for potato chip manufacture.

Commercial Considerations

This was a severe test for modified refrigeration especially with Cars 2, 5, and 6 since the potatoes in these cars were warm (77° to 84°) when loaded. Also, the weather encountered en route was above normal in temperature. The daily minimum and maximum temperatures recorded en route compared with the averages (normal temperatures) for June and July at various stations between Bakersfield and Chicago, taken from U. S. Weather Bureau records, were:

Date	Temperature en route		Station	Normal Average Temperature June		July	
June	Min.	Max.		Min.	Max.	Min.	Max.
22	75	99	Bakersfield, Calif.	61.5	92.6	65.5	93.0
23	77	113	Needles, Calif.	71.8	102.8	80.3	106.0
23			Winslow, Ariz.	52.1	91.5	60.1	93.1
24	57	92	Ft. Sumner, N.M. (near Belen)	53.2	90.5	62.5	93.3
25	60	97	Amarillo, Texas	60.4	85.0	61.9	87.9
26	71	95	Kansas City, Mo. (near Argentine)	64.9	83.0	69.1	87.2
27	71	98	Chicago	59.2	74.3	65.7	79.7

The averages for Bakersfield are for 1948 only and are probably slightly below normal. According to daily news reports the weather encountered east of Chicago was abnormally hot for this part of the country.

With these warm potatoes modified refrigeration was sufficient for delivery of Car 5 to New York City using Rule 247b - initial ice at Bakersfield, re-iced at Belen and Corwith. One re-icing carried the load as far as Chicago (Corwith Yards) without melting all the ice in the bunkers. Since the other cars, including the initially warm Cars 2 and 6 also arrived in good condition it signifies that they had adequate refrigeration in transit.

Concerning the use of fan equipment, Car 2 with "fans on" cooled the top layer of the load much faster than Car 1 with "fans off." Although both cars arrived at the market in good condition , the rapid removal of the field heat in the potatoes is desirable, as accomplished by operating the fans in transit .

The transit temperature in the stage iced cars with fans off (Cars 3 and 6) probably would have been similar to that of the full bunker cars (1 and 4) if

they had been re-iced at all regular stations as provided in the tariff. Stage icing with modified icing service as used in this test resulted in slow cooling of the top layers of the load to the desirable level of 50°. However, stage icing with fans off did not raise the bottom layer temperature to 45° - 50°, as desired.

Inspection of the potatoes upon arrival at the market and after being held at store temperature for 2 or 3 days indicated that the least browning and shriveling occurred when the temperature in transit were maintained at about the 50° level.

The stage iced cars with 5,600 lbs. of ice provided adequate refrigeration between the initial icing point (Bakersfield) and the first re-icing station (Needles). Stage ice Car 3 melted 3,400 lbs. of ice during this time to cool the load about 12 degrees from an initial temperature of 73°; stage ice Car 6 melted 4,100 lbs. and cooled the load 16 degrees from a 73° start; full bunker Car 4 (Rule 200) melted 5,300 lbs. to cool the load 22 degrees from 73°. These three cars were the only ones re-iced at Needles and the ice meltage to this point represents the amount used to initially cool the car structure and load and to absorb the heat leakage from 2 PM June 22 to 10 AM June 23. Maximum ice meltage between icing stations east of Needles was 3,300 lbs. from 4 PM June 24 (Belen) to 11:30 PM June 25 (Waynoka), see Car 4, Table 4.

Weight loss in transit of these moderately skinned potatoes was 2 to 3 percent in top doorway bags compared with 1.3 to 3.4 percent in skinned stock in the test in May 1948, and 1.0 to 1.9 percent in more mature stock in June 1948 test.

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Chas. F. Warren, Agt. S. F. R. D., accompanied the test from Bakersfield California to Belen, New Mexico.

H. A. Silva, Agt. S. F. R. D., accompanied the test from Belen, N. M., to Corwith Yds., Chicago, Ill.

H. T. Cook, Senior Pathologist, U. S. D. A., Beltsville, Md., assisted during inspection of the potatoes at New York City.

G. B. Ramsey, Senior Pathologist and M. A. Smith, Pathologist, U. S. D. A. Chicago, inspected the cars unloaded at Chicago and Decatur, Illinois.

Table 1. List of Test Cars.
California Potato Transportation Test, June, 1949.
Bakersfield, Calif., to Chicago, Ill., and New York City.

Test Car	SFRD	Refrigeration1/	Rule	Destination	Cost 2/ Refrig.
1	7665	Initial ice Bakersfield, Calif. Re-ice Winslow, Ariz., and Argentine, Kansas.	247b	Chicago, Ill.	$79.35
2	7578	Initial ice Bakersfield, Calif. Re-ice Winslow, Ariz., and Argentine, Kansas. Fans ON.	247b	Chicago, Ill.	$79.35
3	7567	Initial stage ice Bakersfield, Calif. Re-ice Needles, Calif., and Waynoka, Okla. 3/	"test"	Chicago, Ill.	$69.44
4	7616	Initial ice Bakersfield, Calif. Re-ice all regular stations.	200	New York City	$105.80
5	7546	Initial ice Bakersfield, Calif. Re-ice Belen, N. M., and Corwith, Ill. 3/	247b	New York City	$84.64
6	7037	Initial stage ice Bakersfield, Calif. Re-ice Needles, Calif., Waynoka, Okla., Corwith, Ill. 3/	"test"	New York City	$62.66
7	7623	Standard ventilation	-	Kansas City, Mo. diverted to Decatur, Ill.	none

1/ All cars loaded dry and forwarded "vents open" to Bakersfield. Fans ON with test Car 2 only.

2/ Not including tax.

3/ Re-iced at destination for holding on track.

Table 2. Car Loading and Shipping Data.
California Potato Transportation Test No. 1, 1949.
Bakersfield, Calif., to Chicago, Ill., and New York City,
June 21-30, 1949. Via Santa Fe and Erie Railroads.

Test car No.	1	2	3	4	5	6	7
SFRD 1/	7665	7575	7557	7616	7546	7037	7623
Loading Point	Cawelo	Cawelo	Cawelo	Wible	Wible	Wible	Arvin
Destination	Chicago	Chicago	Chicago	N.Y.	N.Y.	N.Y	Kansas City
Shipper	Atlantic Commission Co.			F. H. Vanlsing, Inc.			L. L. Covel & Sons
Grower	S. A. Camp (Cawelo)			R. Mettler (Wheeler Ridge)			Claud Bodein (Arvin)
Load	360, 101-lb burlap bags.			400, 101-lb burlap bags.			Same as
Loading	22 stacks 3x5 crosswise of car. 30 bags in doorway wedge.			Same, plus deck layer of 40 bags laid in 2 rows on 20 stacks.			cars 1 to 3.
Refrig. Rule 2/	247	247	Stage Ice	200	247	Stage Ice	Std. Vent.
Fans	OFF	ON	OFF	OFF	OFF	OFF	OFF
Initial icing, lbs.	11,300	11,300	5,600	11,300	11,300	5,600	None
Loading time							
Start	9A	1P	7:30A	1:45P	2:20P	1P	7A
Finish	11A	2P	9A	2:20P	3:05P	1:45P	12M
Potato Temp. °F.	74	62	73	78	62	77	74
Outside Temp. °F.	91	90	77	93	94	89	84
Brand	SAC	SAC	SAC	Limestone	Limestone	Limestone	-
US #1 (%)	94	94	94	95	95	96	US #2
Injury							
Mechan. (%)	2.5	1.5	2.0	.5	.5	.5	1.0
Other (%)	-	1.0 (scab)	.5 (scab)	3.0 (insect)	1.0 (gr. crack)	2.5 (insect)	-
Heat injury (%)	2.0	1.5	1.0	.5	2.0	-	1.0
Browning (%)	0	.5	.5	.5	.2	0	0
Soft Rot (%)	.5	0	.5	0	0	.1	0.2
Skinned (%)	All (5-10)	All (5-10)	All (5-10)	Most (5-10)	Most (5-10)	Most (5-10)	0

1/ 40' fan cars, steel sheathed; insulation 3" walls, 3-1/2" roof; wood floor racks 7-1/2" high, in fair to good repair, smooth.

2/ All cars loaded dry and forwarded to Bakersfield with ventilat[illegible] where they were initially iced to capacity and ventilators closed, non-iced car #7 excepted. With Rule 247 two re-icings were used in transit. With stage ice car #3 two icings only were used in transit plus a third re-icing at destination (Corwin Yds Chicago). With stage ice car #6 three re-icings only were used in transit plus a fourth re-icing at destination (Jersey City Yds New York).

Table 3. Trip Log
California Potato Transportation Test No. 1, 1949
Bakersfield, Calif., to Chicago, Ill., and New York City,
June 21-30, 1949. Via Santa Fe and Erie Railroads.

June	Station	Arrive	Depart	Temp. °F.	Weather
21	Calif. Loading Points (P.S.T.)		(3P)	98	Clear
22	Bakersfield, Calif.		(6A)	70	do.
	do.		(6P)	98	do.
	Mojave	10 P	10:05 P	76	do.
23	Barstow	12:01 A	1:05 A	77	do.
	Enroute	6 A		85	Scattered clouds
	Needles (icing)	7 A	10:15 A	105	do.
	Enroute	11:30 A		113	do.
	Kingman, Ariz.	1:30 P		95	do.
	Seligman	5:15P (P.T.)	7 P (MST)	83	do.
24	Winslow (icing)	1:40 A	4 A	56	do.
	Gallup, N. M.	7:10 A	9:30 A	66	do.
	Belen (icing)	1:50 P	6:50 P	83	do.
	Vaughn	10:35 P	11 P	60	Clear
25	Clovis	2:35A (MST)	5:15A (CST)	70	do.
	Amarillo, Tex.	9:30 A	11:20 A	81	do.
	Canadian	2P	3:20 P	90	Light shower
	Maynoka, Okla. (icing)	8:15 P	12:10 A	82	Clear
26	Wellington, Kan.	5:20 A	6:25 A	70	Scattered clouds
	Emporia	9:50 A	12:15 P	82	do.
	Argentine	3:15 P	9:45 P	94	do.
27	Marceline, Mo.	2:35 A	4:00 A	70	Clear

Table 3. Trip Log (continued)
California Rotate Transportation Test No. 1, 1949

June	Station	Arrive	Depart	Temp °F	Weather
27	Shopton, Mo.	7:30 A	10:10 A	[illegible]	Clear
	Chillicothe, Ill.	1:30 P	2 P	95	Scattered clouds
	McCook	9:15 P	9:45 P	90	do.
	Corwith	8:15 P	10:15 P	76	do.
28	Clearing	11:45 P	2 A	70	Light shower
	Hammond, Ind.	6 A	11:10 A	90	Overcast
	Huntington	2:50 P	3:15 P	90	do.
	Marion, O. (icing)	7:-5 P(CST)	11:15 P(EST)	80	do.
29	Kent	3:10 A	3:40 A	67	do.
	Meadville, Pa.	6.10 A	7:15 A	67	Scattered clouds
	Salamanca, N. Y.	10:20 A	10:50 A	79	do.
	Hornell (icing)	1:35P	9:35 P	7	do.
	Susquehanna, Pa.	9 P	9:35 P	70	do.
30	Port Jervis, N. Y.	1:15 A	2 A	62	Clear
	Ridgewood, N. J.	4:30 A	4:50 A	60	Overcast
	Paterson	5:05 A	5:15 A	62	do.
	Croxton Yds.	5:50 A	6 A	65	do.
	Jersey City	6:45 A		70	do.

Table [illegible] [illegible] RECORD

California State Transportation Test No. 1, 1949
Bakersfield, Calif. to Chicago, Ill., and New York City,
June 21-30, 1949 Via Santa Fe and Erie Railroads.

Test Car No. SFRD Station	Date	Time	1 7[illegible] lbs.	2 7[illegible]8 lbs.	3 7967 lbs.	4 7516 lbs.	5 75[illegible] lbs.	6 7037 lbs.
Bakersfield, Calif.	6/22	2P	11,300	11,300	5,600	11,300	11,300	5,600
Needles, Calif.	23	10A	-	-	3,400	5,300	-	4,100
Winslow, Arizona	24	[illegible]	6,300	6,300	-	2,[illegible]00	-	-
Belen, New Mexico	24	[illegible]P	-	-	-	1,[illegible]25	[illegible],100	-
Waynoka, Okla.	25	11:30P	([illegible])1/	(1/2)	[illegible],100	3,300	(3/4)	[illegible]
Argentine, Kan.	26	[illegible]P	6,000	6,800	(3/[illegible])	1,700	([illegible])	(3/[illegible])
Corwith, Ill.	27	8P	(7/[illegible])2/	(3/4)2/	[illegible],000 2/3/	3,000	7,000	5,000
Marion, Ohio	28	8P				1,[illegible]00	([illegible])	([illegible])
Hornell, N. Y.	29	2:30P				1,200	([illegible])	(1/2)
Jersey City, N. J.	30	7A				(7/8)	(1/2)	([illegible])
Ice supplied initially & enroute			23,500	24,[illegible]0	14,100	[illegible]1,625	26,400	[illegible],100
Est. to refill bunkers at destination			1,400	2,300	4,000 3/	1,400	[illegible]	[illegible]
Total			25,[illegible]00	27,[illegible]0	1[illegible],100	33,025	[illegible]2,000	[illegible]
Less initial icing			11,300	11,300	5,600	11,300	11,3[illegible]0	[illegible],600
Ice meltage in transit			13,700	15,900	12,500	21,725	[illegible]	1[illegible],[illegible]00

1/ Parentheses designate estimate of ice remaining in bunkers.

2/ Destination Chicago.

3/ Ice added to fill bunkers at destination.

Table 5. Weight Loss (50 lb. bags from Top Doorway Position)

California Potato Transportation Test - June, 1949, Bakersfield, Calif., to Chicago, Ill., and New York City. Via Santa Fe and Erie Railroads.

TEST CAR NO.	REFRIG.	DESTINATION AND DATE	BAG NO.	WEIGHT Loading Calif. lbs.	WEIGHT Unloading destination lbs.	WEIGHT After holding 1/ lbs.	LOSS In transit pct.	LOSS During holding 1/ pct.
1	Rule 247	Chicago	16	53.5	52.1	49.7	2.6	4.6
	Fans off	6/28	17	52.5	4[illegible].0	47.8	2.6	[illegible].4
			18	54.5	52.9	51.2	2.9	3.2
			Mean	53.5	51.0	49.6	[illegible].7	[illegible]
2	Rule 247	Chicago	13	54.5	53.3	50.6	2.2	[illegible].1
	Fans on	6/28	14	52.5	51.0	50.3	2.9	1.4
			15	55.0	53.3	52.4	3.1	1.7
			Mean	5[illegible].0	52.5	51.1	2.7	[illegible].7
3	Stage Ice	Chicago	10	55.5	54.2	52.5	2.3	3.1
	Fans off	6/28	11	54.5	52.8	51.2	3.1	3.0
			12	55.5	54.4	49.8	2.0	.5
			Mean	55.2	53.8	51.2	2.5	4.3
4	Rule 200	New York	7	54.0	52.5	-	2.8	-
	Fans off	7/5	8	53.5	52.4	-	2.1	-
			9	55.5	53.8	-	3.1	-
			Mean	54.3	52.9	-	2.7	[illegible].1 2/
5	Rule 247	New York	4	54.0	52.4	-	3.0	-
	Fans off	7/7	5	53.5	51.4	-	3.9	-
			6	53.0	51.4	-	3.0	-
			Mean	53.5	51.7	-	3.3	-
6	Stage ice	New York	1	56.0	55.0	-	1.8	2.6 2/
	Fans off	7/5	2	54.5	Lost during unloading			
			3	54.0	do			

1/ Three days at 50° at Chicago.

2/ Average of 10 selected potatoes held [illegible] days at [illegible]° at New York.

Table 6. Weight Loss of Selected Potatoes 1/ at Market (New York)

TOP DOORWAY				TOP QUARTERLENGTH				BOTTOM BUNKER			
Tuber No.	Weight 1/5 grams	Weight 1/7 grams	Loss pct.	Tuber No	Weight 1/5 grams	Weight 1/7 grams	Loss pct.	Tuber No.	Weight 1/5 grams	Weight 1/7 grams	Loss pct.
	(car #6 Stage ice)										
1	184	177	3.8	11	165	164	.6	21	235	229	2.6
2	277	272	1.8	12	176	173	1.7	22 2/	142	136	4.2
3	204	200	2.0	13	213	207	2.8	23 2/	169	166	1.8
4	154	150	2.6	14	176	173	1.7	24 2/	178	171	3.9
5	123	119	3.3	15	181	178	1.7	25 2/	198	191	3.5
6 2/	214	210	1.9	16	268	261	2.6	26 3/	179	173	3.4
7 2/	203	197	3.0	17	251	245	2.4	27	196	193	1.5
8 2/	186	181	2.7	18	187	185	1.1	28	146	142	2.7
9 2/	160	155	3.1	19 2/	199	197	1.0	29 2/	181	175	3.3
10 2/	203	201	1.0	20	203	198	2.5	30	179	175	2.2
Mean	191	186	2.5		202	198	1.8		180	175	2.9
	(Car #4 Standard Refrigeration)										
41	245	241	1.6					51	229	224	2.2
42	241	236	2.1					52	203	193	1.9
43	264	258	2.3					53 2/	185	180	2.7
44 2/	207	201	2.9					54 2/	172	166	3.5
45	309	303	1.9					55	184	181	1.6
46	158	154	2.5					56 2/	179	171	4.5
47 2/	207	200	3.4					57	180	177	1.7
48 2/	243	239	1.6					58 3/	202	197	2.5
49 2/	165	161	2.4					59 3/	233	223	4.6
50 3/	255	252	1.2					60	254	249	2.0
Mean	229	224	2.2						203	197	3.0

1/ Lots of 10 tubers each, comparable in amount of surface skinned.

Skinned areas ranging from 5 to 15 pct. of surface.

2/ Severe browning.

3/ Very severe browning (nearly black and shriveled at skinned area).

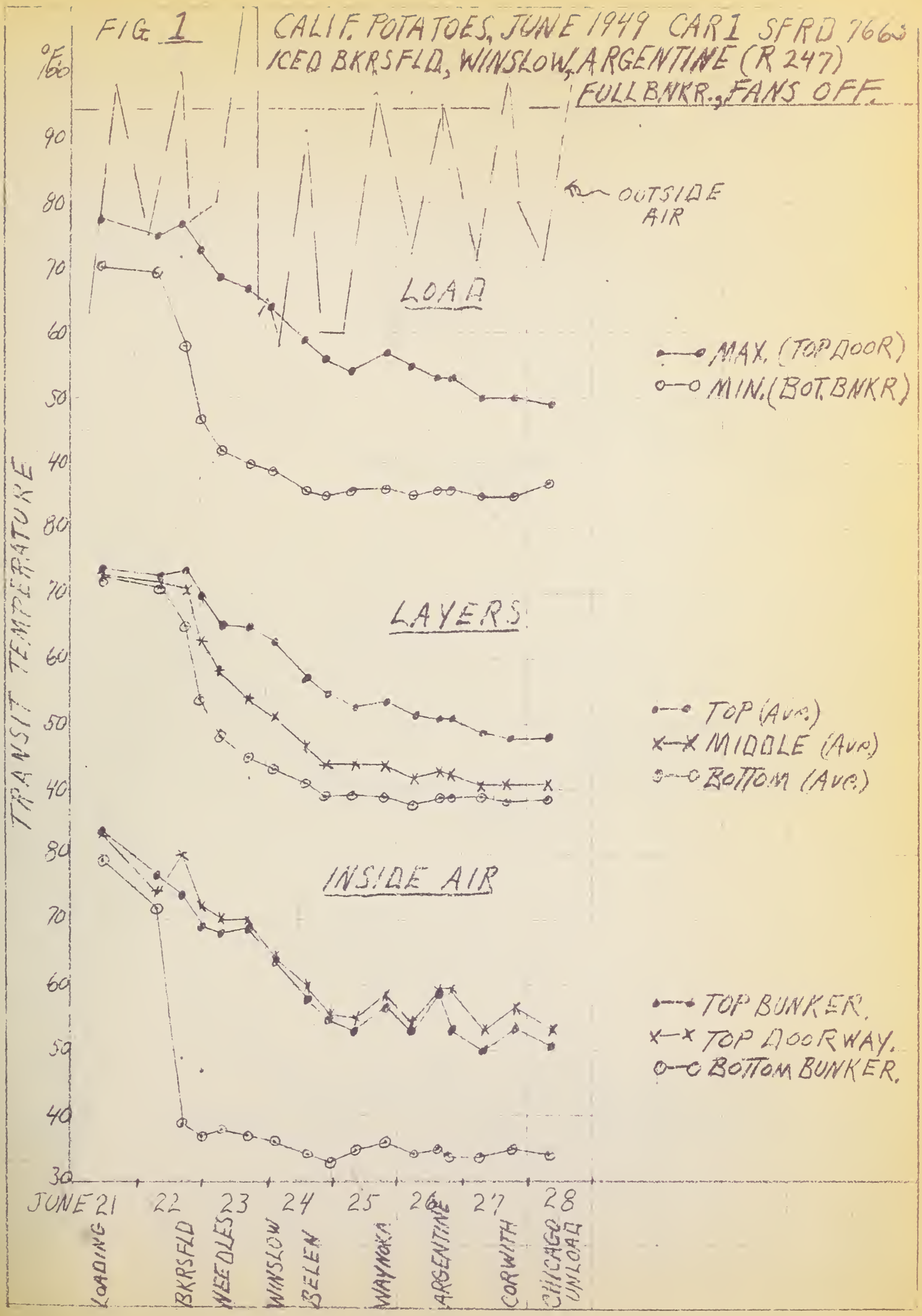


FIG. 1
CALIF. POTATOES, JUNE 1949 CAR 1 SFRD 7660
ICED BKRSFLD, WINSLOW, ARGENTINE (R 247)
FULL BNKR., FANS OFF.
°F
TRANSIT TEMPERATURE
OUTSIDE AIR
LOAD
MAX. (TOP DOOR)
MIN. (BOT. BNKR)
LAYERS
TOP (AVG.)
MIDDLE (AVG.)
BOTTOM (AVG.)
INSIDE AIR
TOP BUNKER.
TOP DOORWAY.
BOTTOM BUNKER.
JUNE 21
22
23
24
25
26
27
28
LOADING
BKRSFLD
WEEDLES
WINSLOW
BELEN
WAYNOKA
ARGENTINE
CORWITH
CHICAGO UNLOAD

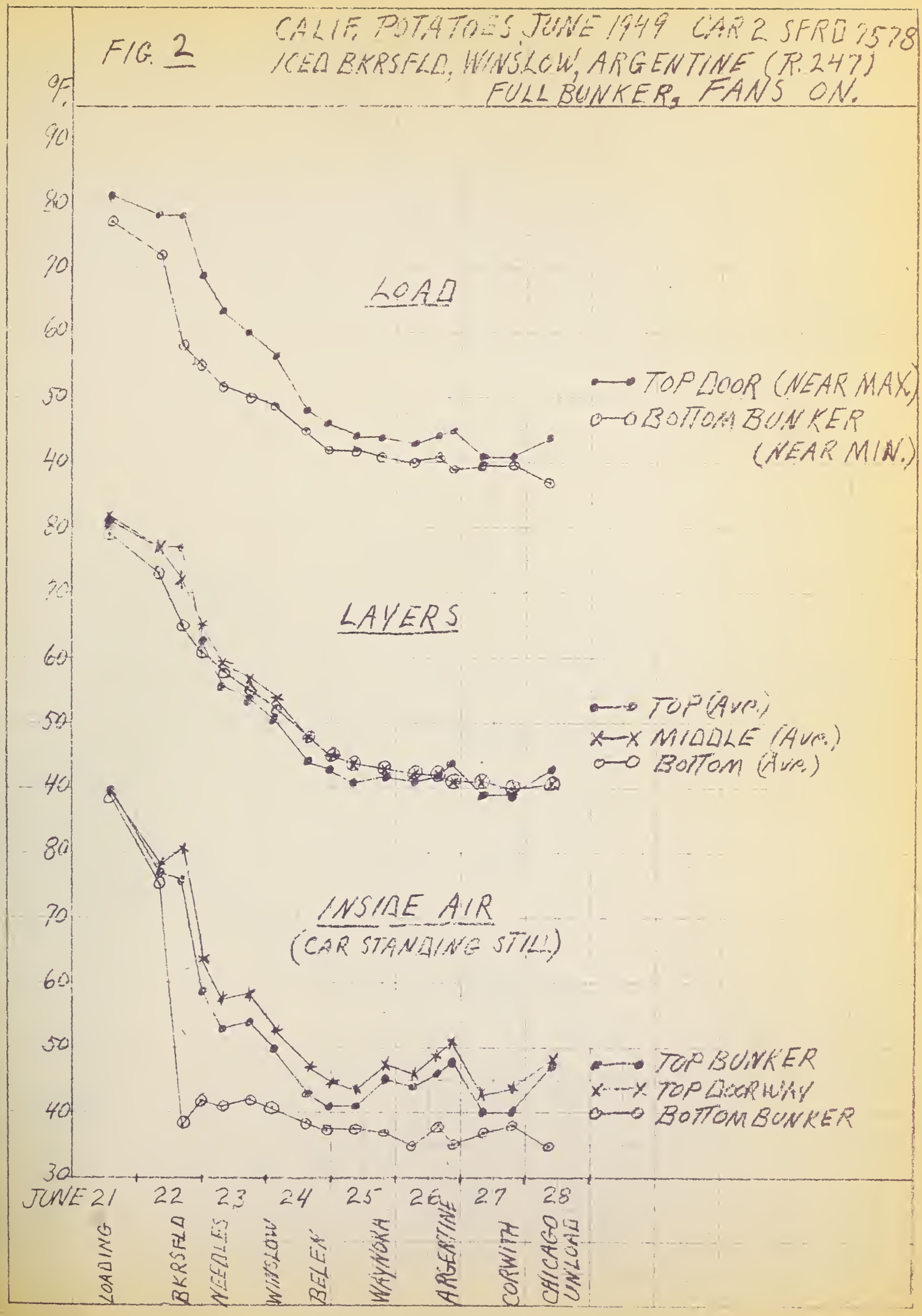
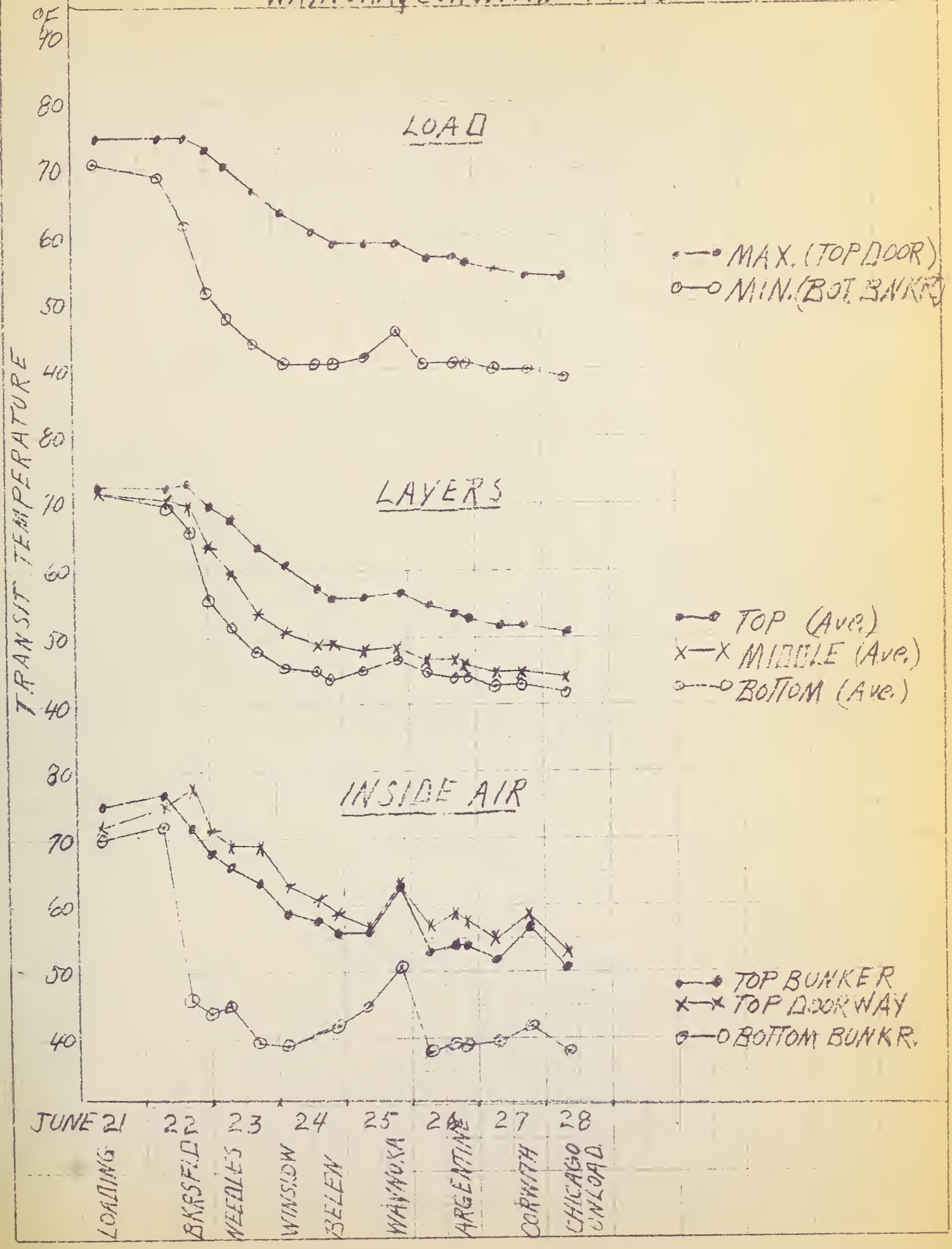


FIG. 2
CALIF. POTATOES JUNE 1949 CAR 2 SFRD 7578
ICED BKRSFLD, WINSLOW, ARGENTINE (R. 247)
FULL BUNKER, FANS ON.
°F.
90
80
70
60
50
40
30
LOAD
TOP DOOR (NEAR MAX.)
BOTTOM BUNKER (NEAR MIN.)
LAYERS
TOP (AVG.)
MIDDLE (AVG.)
BOTTOM (AVG.)
INSIDE AIR
(CAR STANDING STILL)
TOP BUNKER
TOP DOORWAY
BOTTOM BUNKER
JUNE 21
22
23
24
25
26
27
28
LOADING
BKRSFLD
NEEDLES
WINSLOW
BELEN
WAYNOKA
ARGENTINE
CORWITH
CHICAGO UNLOAD

FIG. 3. CALIF. POTATOES JUNE 1949. CAR 3. SFRD. 7567. STAGE ICED BAKERSFIELD, NEEDLES, WAYNOKA, CORWITH. FANS OFF.



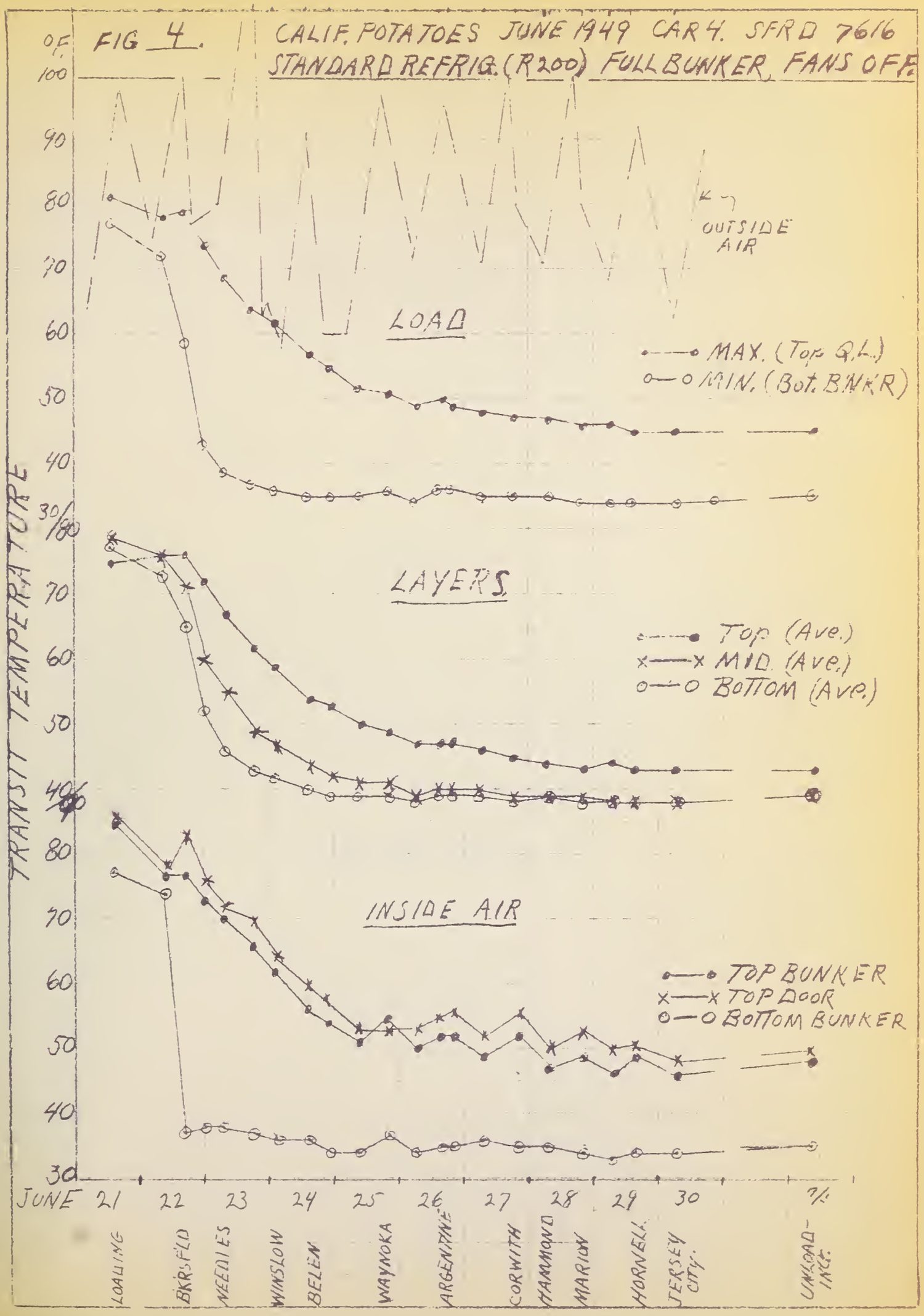


FIG 4.
CALIF. POTATOES JUNE 1949 CAR 4. SFRD 7616
STANDARD REFRIG. (R200) FULL BUNKER, FANS OFF.
°F.
TRANSIT TEMPERATURE
OUTSIDE AIR
LOAD
MAX. (Top G.L.)
MIN. (Bot. BNKR)
LAYERS
Top (Ave.)
MID. (Ave.)
BOTTOM (Ave.)
INSIDE AIR
TOP BUNKER
TOP DOOR
BOTTOM BUNKER
JUNE 21 22 23 24 25 26 27 28 29 30 7/1
LOADING
BKRSFLD
MEEDLES
WINSLOW
BELEN
WAYNOKA
ARGENTINE
CORWITH
HAMMOND
MARION
HORNELL
JERSEY CITY.
UNLOADING

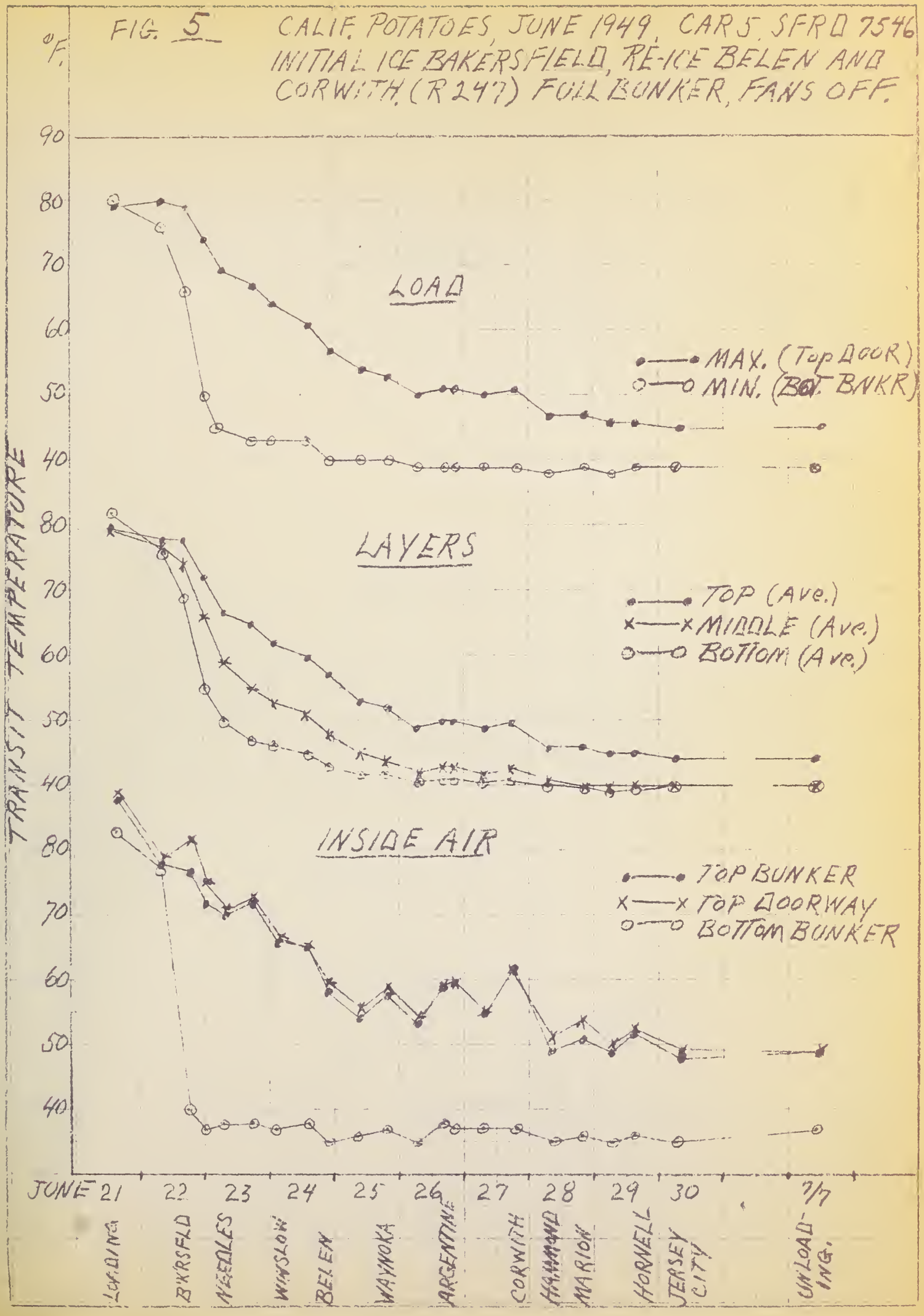


FIG. 5
CALIF. POTATOES, JUNE 1949, CAR 5, SFRD 7546
INITIAL ICE BAKERSFIELD, RE-ICE BELEN AND
CORWITH (R247) FULL BUNKER, FANS OFF.
°F.
TRANSIT TEMPERATURE
90
80
70
60
50
40
LOAD
MAX. (Top DOOR)
MIN. (BOT. BNKR)
LAYERS
TOP (Ave.)
MIDDLE (Ave.)
BOTTOM (Ave.)
INSIDE AIR
TOP BUNKER
TOP DOORWAY
BOTTOM BUNKER
JUNE 21
22
23
24
25
26
27
28
29
30
7/7
LOADING
BKRSFLD
NEEDLES
WINSLOW
BELEN
WAYNOKA
ARGENTINE
CORWITH
HAMMOND
MARION
HORNELL
JERSEY CITY
UNLOADING.

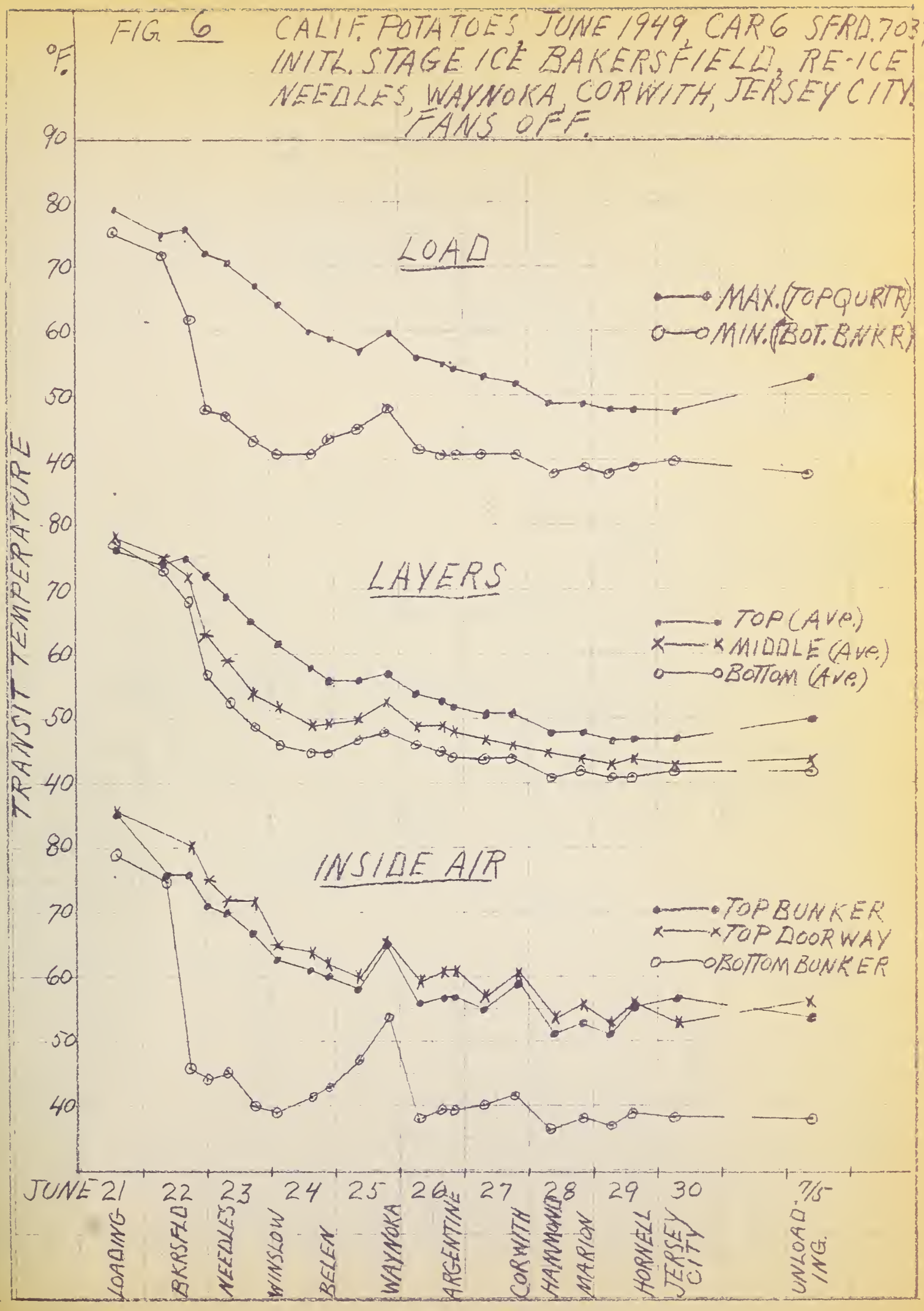
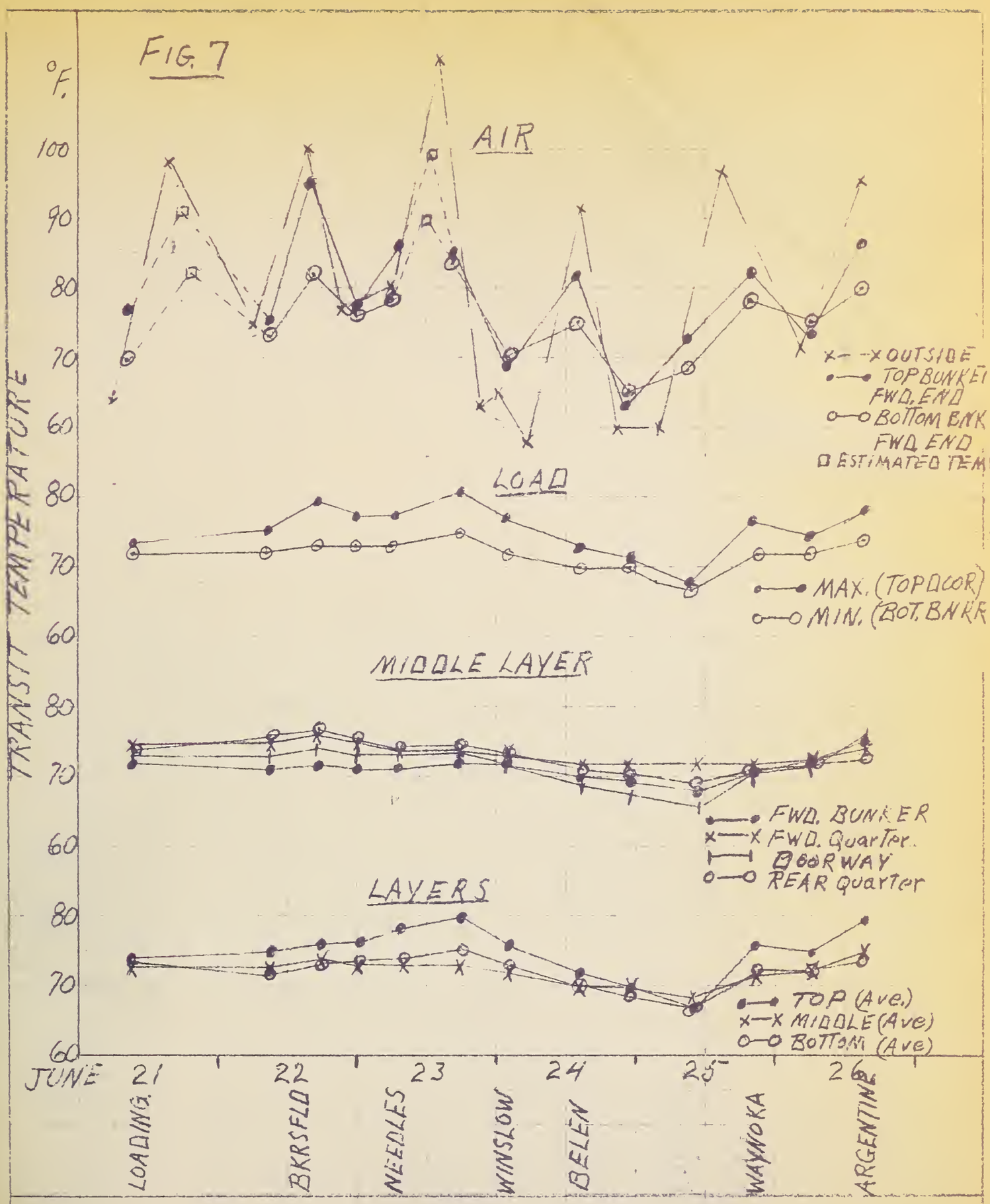


FIG. 6
CALIF. POTATOES JUNE 1949, CAR 6 SFRD.7037
INITL. STAGE ICE BAKERSFIELD, RE-ICE
NEEDLES, WAYNOKA, CORWITH, JERSEY CITY.
FANS OFF.
°F.
TRANSIT TEMPERATURE
LOAD
MAX. (TOP QURTR)
MIN. (BOT. BNKR)
LAYERS
TOP (AVE.)
MIDDLE (AVE.)
BOTTOM (AVE.)
INSIDE AIR
TOP BUNKER
TOP DOORWAY
BOTTOM BUNKER
90
80
70
60
50
40
JUNE 21
22
23
24
25
26
27
28
29
30
7/5
LOADING
BKRSFLD
NEEDLES
WINSLOW
BELEN
WAYNOKA
ARGENTINE
CORWITH
HAMMOND
MARION
HORNELL
JERSEY CITY
UNLOADING



TEMPERATURE CALIF. POTATOES IN TRANSIT JUNE 1949.
S.F.R.D. 7623. BAKERSFIELD, CALIF. to ARGENTINE, KAN.
STANDARD VENTILATION. — VIA. A.T.&S.F. R.R.
FOR POTATO CHIP MANUFACTURE. TEST CAR NO. 7.

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